CONCORDIA UNIVERSITY

MECHANICAL ENGINEERING AT CONCORDIA

SIR GEORGE WILLIAMS CAMPUS
HALL BUILDING,
1455 DE MAISONNEUVE BLVD. WEST
MONTREAL, QUEBEC H3G 1M8

LOYOLA CAMPUS
7141 SHERBROOKE STREET WEST
MONTREAL, QUEBEC H4B 1R6

GENERAL INFORMATION
OPEN HOUSE

MECHANICAL ENGINEERING

AT

CONCORDIA

OPEN HOUSE

PREFACE

This booklet contains the following information:

I - The Open House Arrangements
II - The Mechanical Engineering Programme and Facilities at Concordia, and
III - General Information about Mechanical Engineering as a Career

For further information please feel free to contact the Department (879-5985) or,

Dr. T.S. Sankar (Chairman, Mechanical Engineering Department) 879-4564

Dr. M.O.M. Osman (Coordinator, Mechanical Engineering Department) 879-5839

or one of the following faculty members serving as counsellors:

(1)	Prof. R. Bhat	879-5851	(10)	Prof. H. McQueen	879-5870
(2)	Prof. A. Blach	879-8423	(11)	Prof. S. Sankar	879-4565
(3)	Prof. R. Cheng	879-4552	(12)	Prof. Y. Stepanenko	879-8048
(4)	Prof. W. Habashi	879-8421	(13)	Prof. J. Svoboda	879-8419
(5)	Prof. S. Hoa	879-8420	(14)	Prof. K. Thulasiraman	879-5878
(6)	Prof. T. Krepec	879-8004	(15)	Prof. G. Xistris	879-5986
(7)	Prof. G. Kwok	879-4408	(16)	Prof. K. Krakow	482-0320 x265
(8)	Prof. V. Latinovic	879-8048	(17)	Prof. R. Neemeh	482-0320 x352
(9)	Prof. S. Lin	879-4554	(18)	Prof. J. Saber	482-0320 x404

For General Information please contact:

Dr. J.C. Giguere (Associate Dean, Academic Programmes) 879-5853

Mrs. J. Rawlins (Academic Programme Assistant) 879-5853

CONTENTS

WELCOME TO OUR OPEN HOUSE

OBJECTIVES

We have four objectives for this open house:

1) To provide you with an opportunity to meet our Faculty, technical staff and students in Mechanical Engineering at Concordia.

2) To show you our laboratory facilities and some of the activities taking place therein.

3) To provide you with an opportunity to meet the Chairman and the coordinators of programmes and to discuss with them our programme objectives and curriculum.

4) To give the professors at Concordia an opportunity to meet high school and CEGEP students and to learn of their hopes and plans; and to discuss all aspects of the interface between CEGEPS and the University.

ARRANGEMENTS

To achieve the above objectives, the arrangements made for our open house include:

1) A tour of the Mechanical Engineering Laboratories under the guidance of a faculty member.

2) A meeting with student representatives to discuss the programme and extra-curricular activities.

3) A meeting over coffee and doughnuts with the professors of the department to discuss programme objectives, curriculum and other topics of common interest.

PLEASE FEEL FREE TO ASK QUESTIONS REGARDING THE WORK OF MECHANICAL ENGINEERS, JOB MARKET, OPTIONS WITHIN OUR PROGRAMME CURRICULA ETC.

VISIT TO LABORATORY FACILITIES

Tours start on the ground Floor of the Hall Building throughout the afternoon and are guided by a Mechanical Engineering Professor.

See Visit Plan - Appendix I
See List of Exhibits - Appendix II

1. MECHANICAL ENGINEERING AS A CAREER

The Mechanical Engineer is concerned with the creation of devices, systems, structures and processes for human use as well as applying scientific, mathematical, economic and social knowledge to satisfy specific needs of the community. The services required of mechanical engineers encompass a very wide range of professional activity, such as design, research, development and management carried out in environments of equally diverse nature, such as industry, medicine, private practice, university and government.

Mechanical Engineering is perhaps the most diversified of the traditional engineering disciplines and has made possible many of the technological advances of present times. Representative fields of endeavour for mechanical engineers include all forms of power generating equipment (steam, internal combustion, nuclear, jet, rocket, fuel cells) and their operation and maintenance, the design of mechanisms and machines, controls and automation, vibration analysis, energy studies and environmental control (heating, ventilation and refrigeration), materials handling and precision instrumentation.

Mechanical Engineering is an extremely broad field and is a combination of ideas, imagination, creativity, experience, testing, analysis, and synthesis. Any of the specific fields of practice may involve design (a process of scientific realization of concepts and ideas before actual manufacturing), testing (experimental as well as development to determine performance), research (creating solutions to new problems through analysis and design of processes and products), development (transformation of research into a specific product), operation and maintenance (regular inspection and corrective actions for trouble-free and efficient performance), marketing (sales, installation, and servicing of products or systems), management and administration (project planning, supervision, policy and decision making).

2. JOB OPPORTUNITIES

Training in Mechanical Engineering and professional practice in this field are both very interesting, satisfying and rewarding experiences. The job opportunities are many in primary and secondary industries, government agencies, in teaching or even in private practice and are as diverse as the many thousands of products created by Mechanical Engineers.

In his/her first job after graduation, the typical engineer will usually spend some time learning details of the job, which could not be included in an undergraduate programme. Some employers help this process by organizing in-house training. After this initial period the young engineer begins to assume more and more responsibilities.

The type of function assigned to a Mechanical Engineer depends on many factors such as ability to conceive new ideas, ease in dealing with mathematical concepts, ability to organize, etc. Success, however, as in any other profession, depends on ambition, motivation and continuing study habits.

3. MECHANICAL ENGINEERING AT CONCORDIA

PREFACE

The Department of Mechanical Engineering at Concordia offers one of the best learning experiences in engineering education available on this continent. Its professors have gained world-wide recognition for their activities in both research and engineering practice and have developed a curriculum with the relevance and depth needed for today's technological society, at the same time maintaining close contact with their students.

PROGRAMME

In view of the very wide range of activities in the field, the mechanical engineering curriculum consists of a combination of core courses with a series of technical electives. Strong emphasis is given to building on the principles presented in the basic engineering and physical systems courses of the General Requirements. Further core courses are taken by all mechanical engineering undergraduates and deal with topics basic to the field, including control theory, thermodynamics, fluid mechanics, heat transfer, machine design and metallurgy. Technical electives allow students to obtain a degree of specialization in a particular area of the field, depending on their interests and expected future professional activity. Four general areas of specialization are available, namely:

1) Thermo Fluid and Propulsion Engineering (Option A)

2) Design and Production Engineering (Option B)

3) Automation and Control Systems (Option C)

4) Industrial Engineering (Option D)

The detailed description of the Mechanical Engineering Curriculum is as follows:

ENGINEERING CORE		CREDITS
CHEM C205	General Chemistry I	3.00
COMP C211	Introduction to Computers and Computing	3.00
PHYS C204	Mechanics	3.00
PHYS C205	Electricity and Magnetism	3.00
PHYS C224	Introduction to Experimental Mechanics	1.00
PHYS C225	Introduction to Experimental Electricity	1.00
EMAT C212	Calculus and Differential Equations	3.00
EMAT C232	Matrices and Advanced Calculus	3.00
EMAT C271	Applied Probability and Statistics	3.00
EMAT C391	Numerical Methods in Engineering Systems	3.00
ENGR C212	Technical Drawing	2.00
ENGR C273	Basic Circuit Analysis	3.75
ENGR C281	Technical Literature	2.00

		CREDITS
ENGR C402	Engineering Law	1.50
ENGR C410	Technical Report	1.50

6 credits from the 'Social Aspects of Engineering' group*.

ENGR C491	Engineers and Society
ENGR C492	Historical Impact of Technology on Society
ENGR C493	Engineering, Resources & Environment
ENGR C494	Effect of Technology on the Person
ENGR C495	Technology Assessment and Control
ENGR C496	Science Policy and Engineering Innovation

* For all students, 3 of these 6 credits may be replaced by a specified course or courses in French, subject to the approval of the Assistant Dean, Undergraduate Student Affairs. A list of such courses is available from the Assistant Dean's Office.

MECHANICAL ENGINEERING CORE		Credits
EMAT C311	Transform Calculus and Partial Differential Equations	3.00
ENGR C213	Descriptive Geometry	2.00
ENGR C221	Materials Science	3.00
ENGR C242	Statics	3.00
ENGR C243	Dynamics	3.00
ENGR C244	Mechanics of Materials I	3.75
ENGR C251	Thermodynamics I	3.00
ENGR C274	Physical Systems and Measurements	3.75
ENGR C361	Fluid Mechanics I	3.00
ENGR C372	Fundamentals of Control Systems	3.75
MECH C311	Mechanical Engineering Laboratory I	3.00
MECH C312	Mechanical Engineering Design I	3.00
MECH C321	Strength and Failure of Metals	3.00
MECH C373	Instrumentation and Measurements	3.75
MECH C411	Mechanical Engineering Laboratory II	3.00

OPTION REQUIREMENTS

Options A, B and C

Students in options A, B and C must complete the following courses (list I), plus one option core and a minimum of 9 further elective credits.

List I

ELEC C334	Electric Machinery	3.75
ENGR C214	Machine Drawing	2.00
ENGR C362	Fluid Mechanics II	3.75
ENGR C403	Engineering Economy	1.50
MECH C341	Kinematics of Mechanisms	2.50
MECH C342	Dynamics of Machines	2.50

		Credits
MECH C351	Thermodynamics II	3.75
MECH C352	Heat Transfer I	3.75
MECH C441	Mechanical Engineering Design II	3.00

1. Option Core A - Thermo Fluid and Propulsion

or MECH C452	Heat Transfer II	3.75
MECH C462	Turbomachinery and Propulsion	3.00
MECH C461	Gas Dynamics	3.75

2. Option Core B - Design and Production

MECH C421	Deformation and Mechanical Shaping of Metals	3.75
MECH C445	Machine Design	3.50

3. Option Core C - Automation and Control Systems

		Credits
ENGR C473	Control System Design	3.75
MECH C463	Fluid Power Control	3.75

Choose a minimum of 9 credits from:

		Credits	Preferred for Option
COEN C411	Computer Organization and Software	3.75	B,C
COEN C474	Digital Computers in Systems	3.75	B,C
ENGR C412	Operations Research	3.00	B
ENGR C473	Control System Design	3.75	A,B
ENGR C475	Process Dynamics and Control	3.75	A,C
ENGR C318	Industrial Electronics	4.50	A,B,C
MANA C345	Production Management	3.00	B
MECH C423	Thermal Treatment and Processing of Metals	4.00	A,B,C
MECH C443	Mechanical Vibrations	3.75	A,B,C
MECH C452	Heat Transfer II	3.75	A
MECH C453	Environmental Control	3.00	A,B,C
MECH C455	Introduction to Nuclear Engineering	3.00	A,C
MECH C462	Turbomachinery and Propulsion	3.00	A
MECH C463	Fluid Power Control	3.75	B
MECH C464	Aerodynamics	3.00	A
MECH C465	Gas Turbine Design	3.75	A
MECH C471	Microprocessors and Applications	3.00	B,C
MECH C481	Design or Experimental Project	3.00	A,C

Students may also choose from the following courses, providing these can be accommodated within their timetable:

ENGR C471	Time Domain Analysis and Design	4.00	B,C
ENGR C472	Studies in System Optimization	4.50	C

Normally students choose these options after completion of the second year of their programme by applying to the Department.

Option D - Industrial Engineering

Students in Option D must complete the following courses (list II), plus 6 further elective credits.

List II		Credits
ACCO C213	Financial I	3.00
COEN C411	Computer Organization and Software	3.75
ELEC C318	Industrial Electronics	4.50
EMAT C272	Advanced Probability and Statistics	3.00
INDU C310	Human Factor Engineering	3.00
INDU C313	Industrial Economics	3.00
INDU C320	Production Engineering I	3.00
INDU C321	Production Engineering II	3.00
INDU C323	Industrial Operations Research	3.00
INDU C330	Organizational Management	3.00
INDU C480	Industrial Engineering Project	4.00
INDU C481	Industrial Engineering Seminar	1.00

Choose 6 credits from:

FINA C314	Introduction to Finance I	3.00
INDU C410	Safety Engineering	3.00
INDU C411	Industrial Applications of Computers	3.00
INDU C420	Mathematics of Optimization	3.00
INDU C423	Inventory Control	3.00
ELEC C334	Electric Machinery	3.75
MECH C471	Microprocessors and Applications	3.00

Normally students choose this option after completion of the first year of their programme by applying to the Department.

ACCREDITATION

The programme is accredited by the Accreditation Board of the Canadian Council of Professional Engineers and by the Order of Engineers of Quebec.

FACULTY AND STAFF

The Mechanical Engineering Faculty comprises 7 professors, 8 Associate Professors, 4 Assistant Professors, and several Visiting and Adjunct Professors, Research Associates and Lecturers. They are engaged in industrial as well as theoretical research and development; and many have gained an international reputation. There is considerable cooperation and interaction with industry. To further this cooperation a few specialist courses are taught by practicing engineers and a number of faculty members act as consultants to industry. Appendices III, IV, V, VI, VII and VIII describe the main research groups and their typical projects in the Mechanical Engineering Department.

LOCATION

The Mechanical Engineering Programme can be completed on the Sir George Williams Campus. The first year of the programme is simultaneously offered on the Loyola Campus.

LABORATORIES

Laboratory work supports the classroom lectures and is essential in developing an understanding of engineering principles and applications.

Lab manuals have been written by the faculty which describe in detail the experiments to be carried out. These are made available to the student at the start of the year.

The following is a summary of the major laboratories:

1) Thermodynamics Laboratory
2) Fluid Mechanics and Heat Transfer Laboratory
3) Kinematics and Dynamics Laboratory
4) Vibration and Shock Testing Laboratory
5) Machine Tool Laboratory
6) Fluid Power Laboratory with 100 hp Hydraulic Test Installation
7) Measuring Laboratory with Talysurf and Talyrand Surface Texture Measuring Systems
8) Fluid Control Research Laboratory
9) Control Systems and Automation Laboratory
10) Materials Laboratory
11) Solar Energy Laboratory
12) Instrumentation and Measurements Laboratory
13) Computer Aided Design and Graphics Laboratory

SUPPORTING FACILITIES

1) A well equipped precision Machine Shop staffed by 7 full-time machinists.

2) Central CDC CYBER 172/2 time sharing computer. A separate pamphlet describing the hardware and software is available from the Computer Center.

3) Hybrid computer lab with an EAI 690 system staffed by a full-time simulation engineer and a technical assistant.

4) A dedicated VAX 11/780 computer with 512KB of core memory, two cartridge disk curves (28 MB each), and an additional Winchester disk drive of 675 MB; a Kennedy 800/1600 BPI magnetic tape drive and a NORPAK/VDP high performance, raster scan color video graphic system; a CALCOMP model 1012, 12" drum plotter; a tektronix model 4663, flat bed plotter; and several CRT's.

PROJECTS

Throughout the Programme projects are assigned to enable the student to apply the theories learned and to gain practical experience. In some courses students undertake projects on their own initiative. A few project titles follow:

1) Recycled Car Project.
2) Design of a Solar Heating System.
3) Design of a Deep-Hole Boring Machine.
4) Vibration and Noise Analysis in Vehicles.
5) Pneumatic Braking System on Freight Trains.
6) Design of Flight Simulator.
7) Design of Motor Vehicle Shock-Absorbers and Agriculture Tractor Seat Suspension.
8) Development of Light-Weight Composite Materials and Structures.
9) Bioengineering Projects.
10) Reliability Estimations.
11) Coal Conversion.
12) Interactive Graphics - CAD of an Off-Road Motorcycle.

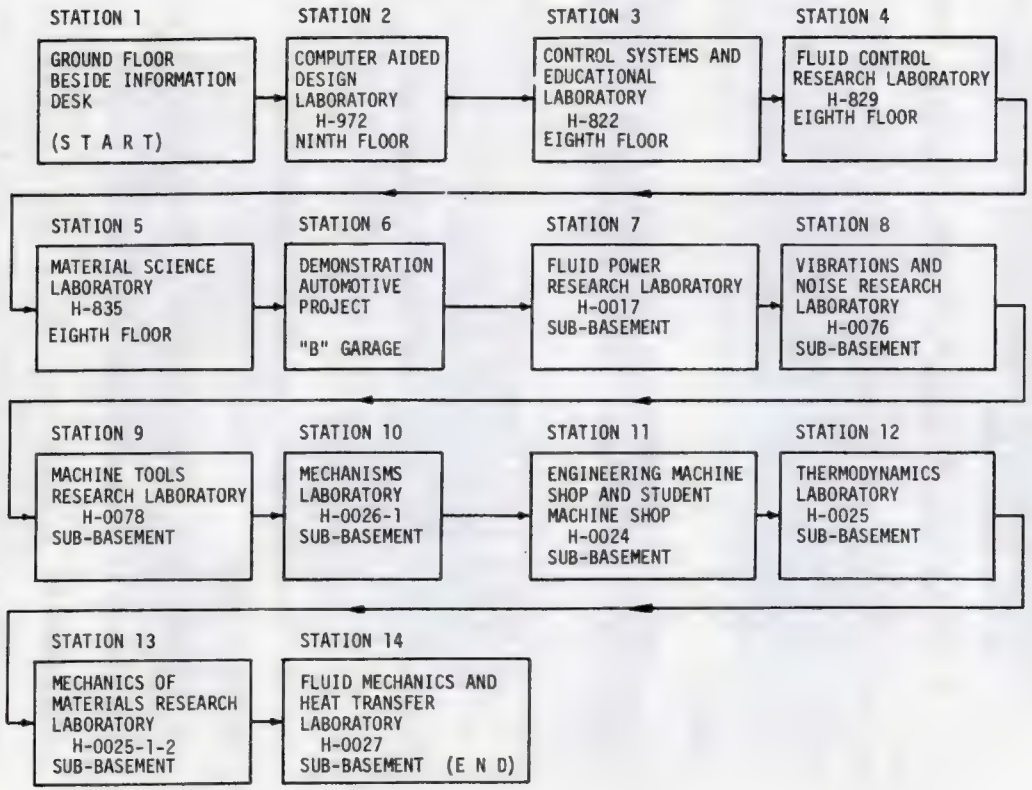
DURATION OF STUDIES

Students who are adequately prepared and who are motivated to work diligently can complete the Programme in six terms. Some may choose, however, to complete the Programme in seven or eight terms. This will allow more time for the many extra-curricular activities available.

COURSE SCHEDULING

Students in the Engineering programme will choose a 6- or 8-term sequence. Due to the heavy workload involved, 6-term sequences are only recommended for the exceptional student. Further information on sequencing may be found in the Programme Guide issued by the Associate Dean, Academic Programmes.

APPENDIX I - TOUR PLAN OF LABORATORY FACILITIES



APPENDIX II

CONCORDIA UNIVERSITY

DEPARTMENT OF MECHANICAL ENGINEERING

Name of Experiment	Location	Equipment	Est. Time	Responsible Faculty Member
1) Computer Aided Design and Interactive Graphics	H-972	VAX 11/780 - Graphics Terminal	10 mins.	Mr. J. Kerr
2) Control System Laboratory	H-822		2 mins.	Mr. B. Suresh
3) Computer-Aided Cutting of Wood for Furniture Making Industry, Microprocessor-Controlled Positioning Table, Pneumatic Stepping Motor, Pneumatic Brake Equipment of Trains; Microprocessor-based fuel control; polar NC-machine	H-829	Fluid Controls Research Laboratory	20 mins.	Mr. A. Fahim Prof. T. Krepec
4) Metallurgical Demonstrations.	H-835	Models, Microscopes & Slides	10 mins.	Prof. H. McQueen
5) Recycled Car Projects	Basement "B"		10 mins.	Prof. C. Kwok
6) Fluid Power Research Laboratory	H-0017	Ship Crane, Hydraulic Circuits, Flight Simulator.	10 mins.	Prof. J. Svoboda
7) Critical Vibrations of Fan Blades	H-0076	Vibration Analysis	3 mins.	Prof. T.S. Sankar
8) Blood Pressure Follower	H-0076	Photoelectric Transducer	3 mins.	Prof. T.S. Sankar
9) Torsional Vibrations and Critical Speeds	H-0076	Vibration Measurement Equipment	3 mins.	Prof. G. Xistris
10) Student Project in Instrumentation	H-0076	Strain Gauge Weighing Machine. LVDT Type Experimental Set-ups.	5 mins.	Prof. S. Sankar
11) Study of Motorcycle Shock Absorber and Seat Suspension	H-0076	Hydraulic Shaker	5 mins.	Prof. S. Sankar
12) Demonstration of Machine Equipment for Deep-Hole Boring & Hydraulic Copying	H-0078	Shaerer-Deep-Hole Boring Machine with Hydraulic Copying Attachment	10 mins.	Prof. M. Osman

Name of Experiment	Location	Equipment	Est. Time	Responsible Faculty Member
13) Power Transmission and Mechanisms	H-0026-1	Demonstration Models for Car Transmission System and the Gear-Box of a Lathe	3 mins.	Prof. M. Osman
14) Main Machine Shop and Student Machine Shop	H-0024	Machine Tools and Measuring Equipment	Walk Through	Tour Host
15) Performance Tests on Internal Combustion Engines & Steam Turbine	H-0025	Engine Test Stand	5 mins.	Prof. W. Habashi
16) Experiments on Fiber reinforced plastic materials	H-0025-1	MTS fatigue machine, Environmental Creep Testing Machine	5 mins.	Prof. S.V. Hoa
17) Demonstration of Different Types of Engines and Their Internal Design	H-0027	Cut-away Models of Gas Turbine, Rotary & Internal Combustion Engines	5 mins.	Prof. M. Osman
18) Drag Measurement on a Model Airplane	H-0027	Subsonic Wind Tunnel	2 mins.	Staff
19) Solar Source Heat Pump for Cold Climates	H-0027	Refrigeration and Heat Pump System	5 mins.	Prof. S. Lin

COFFEE AND DOUGHNUTS WILL BE SERVED IN ROOM H-0027 AT THE END OF THE TOUR

RESEARCH AREAS IN THE MECHANICAL ENGINEERING DEPARTMENT

APPENDIX III - MECHANICAL SYSTEMS GROUP

DESCRIPTION: Research work in mechanical systems at Concordia incorporates vibrations, machine tools, system design, mechanisms, noise analysis, preventive maintenance, computer-aided design and composite materials.

SCOPE OF WORK: Research, development, design with emphasis on production machinery and industrial applications.

FACILITIES: Fully instrumented Machine Tool Laboratory; Mechanical Vibrations Laboratory with 100 lb shaker system; low frequency, long stroke electro-hydraulic shaker; fully instrumented for noise and vibration analysis and shock testing; Measuring Laboratory with Talysurf 4 and Talyrand 51; Kinematics and Dynamics Laboratory; hybrid computing system with direct link to laboratories; deep-hole machining and hydraulic copying research facilities; digital (CDC CYBER 172/2) and hybrid computers.

FACULTY:

M.O.M. Osman, Dr.sc.techn. (Swiss Fed. Institute)	Machine Tool Dynamics, Tribology Metal Cutting, Mechanisms & Gear Transmissions.
T.S. Sankar, Ph.D. (Waterloo)	Vibration Problems in Mechanical Systems and Reliability.
G.D. Xistris, D.Sc.A. Université de Montréal)	Machinery Reliability, Noise and Vibrations and Signal Processing.
S. Sankar, D.Eng. (Sir George Williams)	Computer-Aided Design, Vehicle Dynamics, Optimization Control in System Design.
S.V. Hoa, Ph.D. (Toronto)	Vibration Stress Analysis, Composite Materials, Finite Element Method.
A.E. Blach, M.Eng. (Sir George Williams)	Pressure Vessels and Heat Exchanger Design.
R.B. Bhat, Ph.D. (I.I.T., Madras)	Random Vibrations, Rotor Dynamics, Structural Acoustics.

TYPICAL PROJECTS: Monitoring and analyzing noise and vibrations of industrial machinery, including thermal and vibratory stresses; preventive maintenance routines; analysis and design of energy absorption devices for critical vibrations in machinery elements; short-time acceptance tests for machine tools; evaluation of surface roughness of manufactured components and its influence on properties such as fatigue, bearing strength, lubricability, etc.; off-road vehicle seat suspension; active and semi-active suspension; motorcycle shock absorbers, transmission gear case, fiber glass reinforced plastic pressure vessels.

APPENDIX IV - INDUSTRIAL CONTROL SYSTEMS

DESCRIPTION: Industrial Control Systems incorporate pneumatics, fluidics, hydraulics, electronics and control engineering.

SCOPE OF WORK: Research, development, design and simulation with emphasis on sensing, measurement, automation and control applications in industry; low-cost automation with emphasis on production operation, mechanical transfer and handling; special purpose industrial "robots"; application of control theory and computer methods to the design and analysis of industrial control systems; Computer-aided design interactive simulation.

FACILITIES: Well-equipped research laboratory; experienced staff with design and prototype capability; low-cost automation laboratory open to industry contains about 30 working circuits of typical industrial applications to demonstrate the advantages and potential of new technology; digital and hybrid computer facilities:

FACULTY:

C. Kwok, Ph.D. (McGill)	Pneumatic and Fluidic Systems, Fluid Dynamics.
R.M.H. Cheng, Ph.D. (Birmingham, U.K.)	Design and Analysis of Automation and Control Systems.
J. Svoboda, D.Eng. (Concordia)	Fluid Controls, Hydraulic Systems and Industrial Robots.
T. Krepec, D.Sc. (Warsaw, Poland)	Fuel Control Systems, Internal Combustion Engines.

APPENDIX V - THERMO-FLUID POWER AND PROPULSION

DESCRIPTION: Research at Concordia encompasses experimental, analytical and numerical work in combustion, solar energy, heat transfer, aerodynamics and turbomachinery.

SCOPE OF WORK: Development of modern computational techniques for the analysis of various gas dynamic and aerodynamic phenomena, especially in jet engines and rocket motors; analysis and testing of phase-change, heat transfer processes; design and testing of solar heating and cooling systems; numerical methods in unsteady compressible flow.

FACILITIES: Wind Tunnels; Fluid Dynamics Laboratory; Thermodynamics Laboratory; Heat Transfer Laboratory; Solar Research Laboratory; Heat Pump Laboratory; Digital Computer and Terminal facilities, CDC CYBER 172/2; Combustion Laboratory; Shock Wave Laboratory.

FACULTY:	W.G. Habashi, Ph.D. (Cornell, U.S.A.)	Finite Element Methods in Aerodynamics, Numerical Methods in Turbomachinery.
	K.I. Krakow, M.S. (California Inst. of Technology, U.S.A.)	Environmental Control, Solar Energy.
	S. Lin, D-Ing. (Karlsruhe, W. Germany)	Solar Energy, Heat and Mass Transfer Processes.
	R.A. Neemeh, Ph.D. (McGill)	Shock Wave Physics and Related Phenomena, Unsteady Wave Motion in Compressible Flow.
	A.J. Saber, Ph.D. (Princeton, U.S.A.)	Study of Experimental Methods in Coal Gasification, Rocket Motor Instabilities.

TYPICAL PROJECTS: Finite element method study of aerodynamic flows at high subsonic and transonic Mach numbers; study of acoustic and structural phenomena in solid propellant rocket motors; resonance phenomena and their application; numerical methods in aerodynamics of turbomachines; air and solar source heat pumps; heat and mass transfer in porous media; energy transfer in confined vortex flows; ignition of gaseous mixtures by shock waves.

APPENDIX VI - MATERIALS IN MANUFACTURING

DESCRIPTION: Hot working of metals encompasses the microstructural changes taking place inside the metals; the ductility and strength of various alloys; the simulation of multistage rolling and forging and the product properties. Mechanical behaviour of fiber reinforced plastic composites; fatigue, fracture, creep and effect of environments; analysis using finite element method.

SCOPE OF WORK & FACILITIES: Compression and torsion tests by means of microprocessor controlled equipment; optical and electron microscopy. Composite material fabrication equipment; MTS fatigue testing machine, environmental chamber, photoelastic polariscope.

FACULTY:	H.J. McQueen, Ph.D. (Notre Dame, U.S.A.)	Hot Working of Metals, Energy Conservation in Manufacturing, Energy Strategy, Solar Materials.
	S.V. Hoa, Ph.D. (University of Toronto)	Composite Materials, Stress Analysis.

TYPICAL PROJECTS: Simulation of a hot reversing mill with up-coil furnaces; measurement and flow stress during passes and of softening between passes for both carbon steels and new high strength low-alloy steels. Fatigue and fracture of sheet molding components; fatigue and fracture of graphite/epoxy composites; effect of stress concentration on fracture strength of composite under uniaxial and biaxial loadings; effect of water absorption on the mechanical behaviour of SMC and of graphite/epoxy composites.

APPENDIX VII - INDUSTRIAL ENGINEERING AND RELIABILITY IN SYSTEMS

DESCRIPTION: Research involves (i) development of efficient computational techniques for solving industrial engineering problems; (ii) modeling and performance evaluation of large industrial systems and (iii) reliability problems in systems.

SCOPE OF WORK: (i) Design, mathematical analysis and experimental evaluation of graph and discrete optimization algorithms for problems arising in industrial applications. These problems include: scheduling and sequencing of jobs, network reliability analysis, vehicle routing such as the travelling salesman problem, circuit lay-out, etc.... (ii) Studies in queuing networks and queuing network modeling of large systems such as computer systems. (iii) Investigation of reliability of mechanical systems using direct and indirect methods.

FACULTY:

K. Thulasiraman, Ph.D. (I.I.T., Madras, India)	Graph Theory, Discrete Optimization and Algorithms, Networks and Systems Theory.
T.S. Sankar, Ph.D. (University of Waterloo)	Reliability Analysis and Mechanical Systems.
M.N.S. Swamy, Ph.D. (University of Saskatchewan)	Graph Theory, Signal Processing, Networks and Systems Theory.

TYPICAL PROJECTS: Optimal planar circuit layout; time-table and task scheduling; travelling salesman and routing problems; assembly-line balancing; topological design of computer networks; flow control problems in computer networks; probabilistic methods for reliability estimations for industrial machinery and production lines; failure forecasts for equipment.

APPENDIX VIII - COMPUTER AIDED DESIGN, MANUFACTURING AND ROBOTICS

DESCRIPTION: CAD/CAM and Robotics is an emerging area in Mechanical Engineering which deals with the use of micro-,mini- and large computers in the analysis, design and optimization of mechanical components and systems.

SCOPE OF WORK: Research, development, automated design, automated manufacturing, robotics and manipulators, vehicle design, simulation of industrial products.

FACILITIES: A dedicated VAX 11/780 computer with 512KB of core memory, two cartridge disk curves (28 MB each), and an additional Winchester disk drive of 675 MB; a Kennedy 800/1600 BPI magnetic tape drive and a NORPAK/VDP high performance, raster scan color video graphic system; a CALCOMP model 1012, 12" drum plotter; a tektronix model 4663, flat bed plotter; and several CRT's.

FACULTY:

S. Sankar, D.Eng. (Sir George Williams)	Computer Aided Design of Mechanical Systems, Dynamic Graphics in Vehicle Design, Optimal Design.
R.M.H. Cheng, Ph.D. (Birminghan, U.K.)	Computer Aided Design of Fluid Systems, Automation, Robotics.
V. Latinovic, D.Eng. (Concordia University)	Computer Aided Manufacturing, Production Technology, Graphics.
Y. Stepanenko, Ph.D. (Eng. Research Inst., Moscow)	Robotics and Manipulators, Simulation Methodologies.

TYPICAL PROJECTS:

Some specific research areas are:

(i) Computer aided optimal design of vehicle suspension systems.
(ii) Finite element analysis and dynamic graphics in the design of off-road vehicle structures.
(iii) CAD of sequential circuits for industrial processes.
(iv) CAD of complex mechanical systems through interactive graphics and F.E. analysis.
(v) CAD of rotor-bearing systems.
(vi) CAD of pneumatic stepper motors.
(viii) CAD of fiberglass reinforced plastic pressure vessels.